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ABSTRACT

Recent data from the National Longitudinal Survey of Youth (NLSY) were used to examine the validity of the traditional human capital model, which predicts that training lowers starting wages and increases wage growth. The primary data sample was restricted to those 4,309 members of the NLSY sample who were working for pay and not enrolled in school in 1992 and who started the job held in 1992 after the 1986 study interview. Overall, the analysis did not support the conventional version of the human capital model. The starting wage regressions did not indicate any negative relationship between starting wages and current company training; rather, starting wages and company training appeared to be positively related. Off-site company-paid training proved to be portable across employers. It was concluded that general training is paid for by firms rather than workers, which is inconsistent with the standard human capital model. The estimates from wage growth regressions were more consistent with the human capital model; specifically, company-financed training had a positive impact on wage growth independent of tenure at current job and off-the-job company training was particularly effective in enhancing wages. (Contains 22 references. Appended is data regarding the 35 study variables.) (MN)

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Discussion Paper

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Training, Wages, and the Human Capital Model

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EXECUTIVE SUMMARY

While there are a number of theories as to why wages increase over an individual's work life, a commonly accepted interpretation is that upward sloping wage profiles reflect investments in human capital, particularly investments in job training. The traditional human capital model predicts that training lowers the starting wage and increases wage growth. This study uses recent data from the National Longitudinal Survey of Youth (NLSY) to examine the predictions of the human capital model concerning the relationship between training and wages. In sum, the results, particularly the findings regarding training and the starting wage, do not support the conventional version of the human capital model and suggest that alternatives to the traditional model should be considered.

The results from estimating starting wage regressions indicate that there is not a negative relationship between starting wages and current company training. If anything, starting wages and company training appear to be positively related. Also, the data indicate that off-site company paid training is portable across employers, or is general. Taken together, these results suggest that firms, rather than workers, pay for general training, which is inconsistent with the standard human capital model.

The estimates from the wage growth regressions are more consistent with the human capital model. Training that is company financed has a positive impact on wage growth independent of tenure at the current job. Company training that takes place outside the work place is particularly effective in enhancing wages. This result is interesting given that this form of training appears to be the most general. Hence, while companies appear to finance training that provides skills which are useful both within and across firms, this training may differ from what is commonly considered as "on-the-job" training.

I. INTRODUCTION

There are a number of theories as to why wages increase over an individual's work life. A commonly accepted interpretation of this relationship is that upward sloping wage profiles reflect investments in human capital, particularly investments in job training (Becker 1962; Mincer 1962). An individual's decision to invest in human capital is based upon an examination of the net present value of the costs and benefits of such an investment. Individuals are assumed to invest in training during an initial period and receive returns to the investment in subsequent periods. Workers pay for training by receiving a wage which is lower than what could be received elsewhere while being trained. Since training is thought to make workers more productive, workers collect the returns from their investment in later periods through higher marginal products and higher wages.

Human capital models usually decompose training into specific training, which increases productivity in only one firm, and general training, which increases productivity in more than one firm. Purely general training is financed by workers, and the workers receive all of the returns to this training. In contrast, employees and employers will share in the costs and returns of specific training. Despite these differences between general and specific training, the model predicts that both forms of training lower the starting wage and increase wage growth.

In the absence of direct empirical evidence on training to test the human capital model, a number of alternative theories which minimize the role of training have emerged to explain upward-sloping wage profiles. For instance, it may be true that wages rise with tenure because information about the quality of the match between a worker and a firm reveals itself over time. Wages adjust to reflect the quality of the match and well matched workers remain on the job while those who are poorly matched are most likely to leave (Jovanovic 1979). Other models imply that wages increase with tenure in order to reduce supervision costs, to reduce turnover costs, or to do both (Akerlof and Katz

1989; Lazear 1981; Salop and Salop 1976). Since each of these theories have similar predictions, they are not necessarily mutually exclusive and it is difficult to test these alternative theories. Also, since factors such as job training, match quality, and supervisory inputs are difficult to observe, assessing the relative importance of each theory in the generation of wage-tenure profiles is problematic.

Recent improvements in the available data on training have produced a growing body of literature which analyzes the different aspects of the human capital model and documents the consequences of training. In particular, most studies find that training received from the current employer is associated with increased wage growth (Altonji and Spletzer 1991; Barron, Black, and Loewenstein 1989, 1993; J. Brown 1989; Duncan and Hoffman 1979; Mincer 1988). However, there have been only limited tests of other aspects of the human capital model. For instance, Barron, Black, and Loewenstein (1989) and Parsons (1989) both find no statistically significant relationship between training and the starting wage. Also, although Barron, Berger, and Black (1993) find that training has a negative effect on the starting wage, this effect is small relative to the impact of training on productivity.

In addition, there is only limited evidence as to whether training is specific or general. Lynch (1992), using data from the early years of the National Longitudinal Survey of Youth, concludes that company training is primarily firm-specific. Booth (1993), using data from a group of British graduates, finds some evidence that training is portable across employers, but is much more so for men than for women.

In this paper, recent data from the National Longitudinal Survey of Youth are used to examine the impact of training on starting wages and wage growth. The analysis also provides evidence as to whether training is general or specific. It is found that while training is associated with increased wage growth, the other predictions of the traditional human capital model are not confirmed by the data. In particular, there is evidence that

company training does not lower the starting wage and that training is general. This implies that firms bear the cost of training which is portable across employers.

The paper proceeds as follows. In the next section, a description of the data used here is provided. Section III presents results from estimating the impact of training on starting wages, while Section IV provides estimates from wage growth equations. Section V offers some concluding remarks.

II. THE DATA

In this analysis, data from the National Longitudinal Survey of Youth (NLSY) are used to examine the impact of prior and current training on starting wages and wage growth. Past research using the NLSY, such as that by Lynch (1992) and Parsons (1989) has used information from the 1979-86 surveys, where time spent in private sector training is only available for programs that last over a month. In subsequent years, the training questions in the survey were changed so that respondents were asked about all types of training (up to four programs) since the last interview, regardless of duration.[1] Consequently, past research using the NLSY captures the effects of participation in relatively formal training programs. Lynch (1992) reports a company training incidence of 4.2 percent, while the more recent NLSY data indicates that the incidence is about 20 percent (Bureau of Labor Statistics 1993), suggesting that early NLSY data misses the majority of training events.

The NLSY is a sample of approximately 10,000 young men and women who were between the ages of 14 and 22 in 1979 and who have been interviewed annually since that year.[2] It is possible to create a measure of hours spent in training programs taken after the 1986 interview date by taking the product of answers to separate questions about the number of weeks of training and hours per weeks of training. The training programs exclude any training received through formal schooling. Also, while the measures of

training are more comprehensive than those available from the 1979-86 surveys, they do not capture the extent of informal training.

A key feature of the NLSY is that it garners information in an event history format, in which dates are collected for the beginning and ending of important life events. In particular, the starting dates and ending dates of all jobs are recorded, as well as are the timing of training programs. Based upon the timing of these events it is possible to create measures of training received on the current job along with measures of training received prior to the current job.

While the earlier years of the NLSY data primarily provide information on where the training took place, the more recent data include information both on training location and on who pays the direct costs of this training. Incorporating data on the payer of the direct costs of training is particularly important when estimating the effects of training on the starting wage. Presumably, even though some employers pay for the explicit costs of training, employees indirectly pay for "company paid" training through a lower starting wage.

The issue of who pays for the training is also important since many company training programs take place "off-the-job." For instance, classes which offer training in the latest developments in the field, such as changes in accounting laws, advancements in computer technology, or new medical techniques may not take place at the work site, but be directly financed by the employer. Yet there may also exist some forms of training that take place "on-the-job," but are financed by the employee. In particular, seminars or classes which provide more general skills, such as those in management, leadership, public speaking, or a foreign language may occur at the work site but be paid for by the worker.

Consequently in this analysis, training is separated into categories based upon location and payer.[3] Since the focus here is primarily on the effect of company or "on-the-job" training on wages, location is divided into categories of "on-site" and "off-site,"

and payer is broken into "company paid" and "other paid," where "other paid" includes training paid for by the individual, family, government, or other external sources.[4] The resulting four categories are: on-site, company paid (ON-CP); on-site, other paid (ON-OP); off-site, company paid (OFF-CP); and off-site, other paid (OFF-OP). When estimating the impact of training on starting wages and wage growth, these categories are also broken into training received prior to the current job and training received while at the current job.

The primary sample used here is restricted to those who were working for pay and not enrolled in school in 1992, who started the 1992 job after the 1986 interview date, and with nonmissing information on other variables used in the analysis. The employment restriction does not imply that the respondent was working at the 1992 interview date, but had to be working at some time over the interview year. The resulting sample is a group of 4,309 young men and women who were age 27-35 in 1992, and it is important to note that the results are specific to this age cohort. However, the skill acquisition of this age group is of particular interest given that past reports indicate that most formal employer-based training is provided to workers between the ages of 25 and 34 (Carnevale and Gainer 1986).

Since the sample is limited to those who began the 1992 job after the 1986 interview date, complete data on training received while working with the current employer are available for all sample members. While information on training received prior to the 1992 job is incomplete, the impact of previous training may also be partially captured by examining the effect of prior work experience on wages. In addition, although only those with six or fewer years of current job tenure are analyzed, the impact of this restriction on the randomness of the sample is minimized given that young workers are extremely mobile (Bureau of Labor Statistics 1992; Topel and Ward 1992).[5]

Table 1 provides information on the receipt of the different forms of training and time spent in training by sample members. Approximately 25 percent of the sample

received on-site, company paid training, while over 14 percent received company paid training which took place outside the work place. About 16 percent participated in off-site training which was self paid or not employer financed, while slightly over three percent received training at the work site which was not directly financed by the firm. The percentage of individuals receiving company training is slightly higher than that suggested by previous research, which indicates that between five and twenty percent of workers receive company training (C. Brown 1989), although the samples, time frame, and measures of training vary substantially across studies.[6] In particular, most prior studies examine training received from the current employer, whereas in this study training received from multiple employers over an extended time frame is analyzed.

Recipients of off-site, other paid training spent on average over 450 hours in these programs, which is more than any other source. This category includes training received from vocational/technical schools, business schools, and correspondence courses, and these programs are probably more formal than some of the on-the-job training programs. The standard deviations for each of the forms of training are relatively large, and the medians of the training durations indicate that these measures are skewed to the right.[7] The medians also indicate that all forms of training other than off-site, other paid training are relatively short in duration. For instance, one-half of the recipients of on-site, company paid training spent 50 hours, or on average about one full working day per year in this form of training over the six year time span.

II. TRAINING AND STARTING WAGES

The impact of training on starting wages is estimated by specifying the following wage equation:

$$\ln w_s = \alpha_p T_p + \alpha_c T_c + \beta X + \varepsilon \qquad (1)$$

where $\ln w_s$ is the log starting wage rate of the job held in 1992, T_p is training received prior to the current job, T_c is training received at the current job, X is a vector of worker

and firm characteristics, and ε is a standard error term.[8] The X vector includes variables such as prior work experience, sex, race/ethnicity, education, firm size measures, urban residence, local unemployment rate, health status, union status, marital status, as well as occupation and industry dummy variables. In addition, an individual's score on the Armed Forces Qualifying Test (AFQT) is included and taken to be a measure of ability.[9]

As mentioned, except for the studies by Lynch (1992) and Booth (1993), the impact of prior training on wages has been ignored, since creating a measure of past training (T_p) requires the use of longitudinal or quality retrospective data. The human capital model predicts that training received at the current job is negatively related to the starting wage ($\alpha_c < 0$). Prior training has a positive impact on the wage if training is general ($\alpha_p > 0$), but has no impact if training is firm-specific ($\alpha_p = 0$).

Although the data provide for an extremely rich set of variables which control for individual heterogeneity, including a measure of ability, there remains the possibility that individuals are nonrandomly selected into training based on unmeasured factors, which biases the estimates of the effects of training on wages. For instance, if individuals who participate in training are exceptionally motivated, the estimates of the effect of the training measures may be biased upwards.

There are two methods typically used to deal with this problem. The first is to use a "treatment effects" two-step procedure similar to that described by Heckman (1979), where the "treatment" is participation in training. A training receipt probit is estimated in which the dependent variable takes the value one when any form of training is received, and the independent variables are similar to that used in the wage regressions. Yet successful implementation of this model requires the inclusion of an instrument in the training participation equation which is uncorrelated with wages. In this analysis, identification of this model is achieved by merging variables on occupational schools to the NLSY. These variables are available from the 1992-93 Institutional Characteristics Survey sponsored by the National Center for Education Statistics. A variable which

represents the number of occupational schools in an individual's locality which offer programs of two years or less, as well as a variable which reflects the size of the largest occupational school in the locality, based on total enrollment, are included in the training receipt probit, but are excluded from the wage equation.[10] Presumably these institutional measures reflect an individual's potential access to training, and are reasonable candidates as determinants of training, but not of wages.

The second method used to correct for unobserved heterogeneity involves estimating a first-differenced fixed-effects model such as:

$$(2) \qquad \Delta \ln w_s = \alpha_p \Delta T_p + \alpha_c \Delta T_c + \beta \Delta X + \Delta \varepsilon$$

in which the dependent variable is the change in log starting wages between two time periods, and the independent variables are changes in prior training, current training, and other individual characteristics between periods. In order to generate measures of changes in wages as well as changes in the key independent variables, particularly changes in prior training, it is necessary to examine people who changed jobs at least twice between 1986 and 1992 (the change in prior training is zero for those who held only one job after 1986). Consequently in the fixed-effects specifications, the subsample includes those individuals for which the 1992 job represents at least the second job change from 1986-92. There is an additional selection issue since this subsample is more likely to consist of "movers" and may be selected nonrandomly. If the propensity to change jobs is considered to vary across individuals and not over time for a given individual, it is eliminated by the first-differencing procedure. Otherwise, it is necessary to include a selection term in the wage change regressions which accounts for the nonrandomness of the subsample. In the wage change estimations, separate specifications which include and exclude a selection term generated from a job mobility probit equation are reported.[11]

Table 2 presents estimates from log starting wage equations. For ease of presentation, only the estimates of the training, experience, and ability coefficients are

presented. Also, due to the skewness of the training measures and so that the estimates can be interpreted as elasticities, these independent variables are in logarithmic form.[12] The estimates in column (1) provide no evidence that current training is negatively related to starting wages, as all of the variables which reflect training received by the current employer are unrelated or are actually positively related to the starting wage. Interestingly, both on-site and off-site company paid training are positively related to the starting wage. While there is a negative association between being trained at the interview date and starting wages, it is not statistically significant.[13]

Previous OFF-CP is positively related to the starting wage, indicating that this form of company paid training is general since it is portable across jobs. Conversely, previous OFF-OP is negatively related to starting wages, suggesting that those who receive this form of training, which includes training received from vocational schools and business schools and is usually self paid, do not see a return to this form of training through an increased starting wage. The difference in the impact of OFF-CP and OFF-OP on wages implies that firms are particularly effective in financing skill enhancements which are useful to other employers.

The results indicate that education, ability, and prior experience are all positively related to starting wages, as might be expected. Each of these variables has a much larger impact on wages than previous company paid training, although the experience variables may also partially capture the effect of prior training. A ten percent increase in previous OFF-CP increases starting wages by about .2 percent, while similar increases in education, ability, and experience improve starting wages by approximately 4.6 percent, 1.2 percent, and .7 percent, respectively.

Results from utilizing the two-step treatment effects model are presented in specification (2).[14] The estimates for the training variables and the other variables are fairly similar those in specification (1) and the selection term is not significant, suggesting that there is little selection bias in the reduced form wage equation.[15] Hence,

if this method adequately controls for self-selection, the results imply that off-site company paid training is portable across jobs, and that workers do not pay for this training through a lower starting wage, in contrast to the predictions of the human capital model.

These findings are somewhat different than that found by Barron, Berger, and Black (1993) who found a small negative effect of current training on the starting wage, and that of Lynch (1992) who found that company training is specific and not portable across employers. These differences may be due to the different measure of training used here as opposed to those used in the other studies. For instance, Barron, Berger, and Black use training intensity, or cumulative hours per week of training, because they argue that this measure is less likely to be correlated with unobserved ability than total training duration. Also Lynch, due to restrictions imposed by the data, uses only training durations for programs which lasted over four weeks.

Specification (3) presents estimates when training intensity is included as the training measure rather than training duration. The results are similar to the other specifications except that the positive impact of both current and past training on wages is somewhat larger and more significant, suggesting that using the training intensity measure rather than training duration does not necessarily lessen any effect of unobserved ability on the estimates. Specification (4) presents results which include only training durations of four weeks or more. Similar to Lynch, the estimates indicate that these training programs are not portable across employers. Hence, some of the longer forms of company training may be more firm-specific than the shorter programs. Yet unlike Lynch, who found that off-the-job training is primarily general, the results imply that off-site training which is not company paid is negatively related to wages. These differences indicate that proprietary institutions play a less important role in enhancing wages at later ages as opposed to when workers are just out of school.

Specifications (5) and (6) present estimates when the sample is stratified by gender. The estimates suggest that men are likely to experience a positive association between current ON-CP and starting wages, while women are not. Yet women who undertake on-site training at their own expense or acquire funding outside the firm receive a higher starting wage than other women. Also, previous OFF-CP appears to be particularly portable among women compared to men.

Although the two-stage method is an attempt to control for unobserved factors which may bias the estimated training coefficients, a first-differenced fixed-effects log starting wage specification might be considered "cleaner" since it does not rely on the nature of the training receipt probit and the instruments used in that equation. Table 3 presents results from estimating first-differenced log starting wage equations for those employed in 1992 and who changed jobs at least twice from 1986 to 1992, which is about half of the sample (2,237 out of 4,309).[16] Similar to the results for the wage level estimates, current ON-CP is strongly positively related to starting wages, although current OFF-CP is unrelated to starting wages in the change specification. The other forms of current training are unrelated to the change in the starting wage. Hence, the estimates provide no evidence that training lowers the starting wage.

Similar to the wage level results, previous OFF-CP is positively related to the change in starting wages, suggesting that company financed off-site training is portable. The change specification also indicates that prior on-site training which was paid by the individual or other non-company sources has little benefit at future jobs and is actually negatively related to a change in the starting wage. Somewhat surprisingly, change in experience has no significant impact on the change in starting wages. Thus previous off-site company paid training appears to be more valuable across jobs than other forms of training as well as past work experience.

Since the first-differenced estimates are based upon a subsample of people who change jobs multiple times, or are more likely to be "movers," the results in specification

(2) include a selection term which accounts for the possible nonrandomness of the subsample. The selection term is positive and significant, indicating that the first-differenced specification does not completely remove the effects associated with movements across jobs, and that "movers" gain, which is consistent with findings by Topel and Ward (1992). Despite the significance of the selection term, the estimates on the training variables and the other variables are only slightly altered when using the two-stage approach.

Estimates from specifications stratified by gender are presented in columns (3) and (4).[17] Similar to the starting wage level results, the estimates indicate that there is a positive association between current ON-CP and starting wages for males, but not for females. Changes in previous OFF-CP are positively related and changes in previous ON-OP are negatively related to starting wages only for males. Increases in work experience, which may partially reflect the extent of previous training, have a positive impact on wage change for women, but not for men. However unlike the wage level results, no form of training is significantly related to starting wages for females in the change specification. This gender difference in the effects of prior training is similar to findings by Booth (1993) for British graduates, who finds that men receive training which is more portable across jobs than women. The difference between the wage level and the wage change results suggests that heterogeneity may play a larger role when examining the relationship between wages and training for women than for men.

Hence, both the starting wage level and the wage change estimates indicate that there is not a negative relationship between starting wages and current company training. If anything, starting wages and company training appear to be positively related. Also, the data indicate that off-site company paid training is portable across employers, or is general. Taken together, these results suggest that firms, rather than workers, pay for general training, which is inconsistent with the standard human capital model.

IV. TRAINING AND WAGE GROWTH

The impact of training on wage growth is estimated using the specification:

$$(3) \qquad \ln (w_c/w_s) = \gamma_p T_p + \gamma_c T_c + \theta Y + \nu$$

where w_c is the current wage at the 1992 job, T_p, T_c, are defined as in the previous section, Y is similar to the previously defined X vector but also includes tenure at the current job, and ν is the error term. The human capital model predicts that current training is positively related to wage growth ($\gamma_c > 0$), while previous training should have no impact on wage growth ($\gamma_p = 0$). Similar to the starting wage equation, the estimated impact of training may be affected by unobserved factors such as ability and motivation. In order to address this issue, specifications which include the selection term generated from the training receipt probit discussed in the previous section are also estimated.

In addition, the following first-differenced fixed effects model is estimated:

$$(4) \qquad \Delta \ln (w_c/w_s) = \gamma_p \Delta T_p + \gamma_c \Delta T_c + \theta \Delta Y + \Delta \nu$$

where the dependent variable is the change in log wage growth between the 1992 job and the job held immediately prior to the 1992 job, and the independent variables also represent changes between jobs. Again, since change in prior training only occurs for those who change jobs multiple times, this equation is only estimated for the subsample of "movers" and the results from a specification which includes a selection term based upon job mobility is presented.

The results from estimating equation (3) are presented in Table 4. The estimates indicate that current company paid training, both on-site and off-site, is positively related to wage growth, which is similar to the findings from most prior studies (Altonji and Spletzer 1991; Barron, Black, and Loewenstein 1989, 1993; Brown 1989; Duncan and Hoffman 1979; Mincer 1988). Also, tenure on the current job, which may reflect the extent of informal training, is positively related to wage growth. The implied elasticities indicate that a ten percent increase in tenure increases wage growth by .3 percent, while OFF-CP and ON-CP do so by slightly less than .2 percent and .1 percent, respectively. In

addition, as predicted by the human capital model, prior training is unrelated to wage growth, as are education, prior experience, and ability.

These results, along with the findings on starting wages, suggest that firms use education, experience, and ability primarily to offer competitive starting wages. After the worker spends some time with the firm and the employee is trained, wage increases within the firm are largely a function of tenure and training. Hence, while education, experience, and ability may serve to gain access to jobs and to receive training opportunities, they do not necessarily improve wage growth.

Estimates from a specification which includes the selection term generated from the previous described training receipt probit are presented in column (2). Similar to the starting wage regressions, the training receipt selection term is insignificant, and the results are only slightly altered when the term is included in the wage growth equation. Regressions stratified by gender, presented in specifications (3) and (4), indicate that current ON-CP is particularly effective in increasing the wages of females, while OFF-CP has a significant impact on wage improvement for both men and women. For males, previous ON-CP is negatively related to wage growth, which likely occurs because this form of training primarily affects starting wages rather than current wages.

Table 5 presents results from estimating the first-differenced wage growth equations.[18] Similar to the previous wage growth estimates, specification (1) indicates that changes in current OFF-CP are positively related to wage growth. However, unlike the previous results, the change specification suggests that changes in current ON-CP are unrelated to wage growth. Although changes in tenure are positively related to the change in wage growth, the magnitude of the impact of tenure is actually less than that of current OFF-CP. A ten percent increase in previous OFF-CP increases wage change by over .3 percent, while a similar increase in tenure increases wage change by about .2 percent.

Changes in current OFF-OP are negatively related to wage growth, and given the results from Table 2 which indicate that previous OFF-OP is negatively related to the starting wage, there is little evidence of any type of return to this form of training. In particular, individuals who receive training from business schools or vocational schools and who self-pay or receive financing through other sources appear not to receive any improvements in starting wages or in wage growth from the training.

Specification (2) includes a selection term to account for the fact that the first-differenced estimates are restricted to those who have changed jobs multiple times from 1986 to 1992. Similar to the starting wage change results, the estimates on the training variables and the other variables are only slightly altered when using the two-stage approach. Yet unlike the starting wage estimates, the selection term is insignificant, suggesting that the first-differenced approach eliminates unobserved differences associated with job mobility.

Specifications (3) and (4) present separate estimates by gender. For both men and women, changes in current OFF-CP are positively related to changes in wage growth. Females who experience increases in ON-CP also undergo increased wage growth, although the magnitude of the impact of this form of training is relatively small, as it is less than half that of OFF-CP. Among women, the impact of both these forms of training are greater than that of tenure, which is unrelated to changes in wage growth. Also for females, there is a negative relationship between changes in previous ON-CP and changes in wage growth.

Thus, the wage growth estimates are for the most part consistent with the human capital model. Training which is company financed has a positive impact on wage growth independent of tenure at the current job. Also as predicted by the model, previously accumulated human capital is either unrelated or negatively related to wage growth. The most curious result is that the type of company training which is particularly effective in enhancing wages takes place outside the work place. This result is

particularly interesting given that this form of training appears to be the most general. Hence, while companies appear to finance training that provides skills which are useful both within and across firms, this training may differ from what is commonly considered as "on-the-job" training.

V. CONCLUSION

This study uses recent data from the National Longitudinal Survey of Youth to examine predictions of the human capital model concerning the relationship between training and wages. The results do not support the conventional version of this model. While current company training is positively related to wage growth, the data indicate that workers do not pay for company training through a lower starting wage. Also, off-site company paid training is portable across employers, or is general.

Why does it appear that employers pay for general training? What do these results mean for the traditional human capital model? There are a number of possible implications. First, the conventional human capital model might still hold true if there remains unobserved factors which affect the estimates. In particular, if the highly able and the most motivated are the ones who are trained, receive higher starting wages, and experience greater wage growth than others, these unobservables could be driving the results. Yet this explanation is doubtful given the multiple methods used here to control for heterogeneity, which includes the use of a particularly rich set of explanatory variables and the estimation of a two-stage treatment effects model as well as a fixed-effects specification.

Second, it may be the case that workers pay for training through reduced non-wage compensation rather than through a lower starting wage. For instance, health benefits, vacation days, sick days, or other non-wage components may be altered by firms in order to finance the provision of training. This hypothesis is difficult to test using the NLSY given that it provides no information on the receipt or value of fringe benefits.[19]

Evidence from Barron, Berger, and Black (1993), however, indicates that there is no relationship between training receipt and the provision of fringe benefits.

Third, the traditional human capital model might be altered slightly by introducing factors such as uncertainties about the usefulness of skills, the transactions costs of moving, or some form of implicit contracts. Firms will provide training if they know that they can somehow recoup the costs of this training, regardless if the training is specific or general. Since most company training programs are relatively short, the costs of these programs may be relatively low. So for example, if employers can increase job tenure by a small amount by offering workers a post-training wage which is less than the value of marginal product but greater than the alternative wage net of the transactions costs of moving, firms could potentially recoup training costs without lowering the starting wage.

Fourth, the traditional human capital model could be considered in conjunction with other models, such as the matching model. For instance, the finding that training is portable across employers may suggest that training partially serves to improve future job matches. Potential employers may view the skills of trained workers as less uncertain than that of untrained workers, and training may serve to improve workers' knowledge about the types of jobs for which their skills are best suited.

Fifth, the results might suggest that the standard human capital model should be completely abandoned in favor of other models which provide other explanations of upward sloping wage profiles. In particular, Akerlof and Katz (1989) present a second best model in which workers do not pay up-front employment bonds, but employers utilize deferred payment mechanisms and must pay efficiency wages to minimize shirking. This implies the existence of a dual labor market or of "good" and "bad" jobs, and the good jobs are associated with higher starting wages, greater wage growth, and more training. Data sources on training which provide detailed information on employer practices as well as on the characteristics of workers will go a long way towards sorting out the alternatives to the traditional human capital model.

Notes

[1] Although no training questions were included in the 1987 survey, the training questions in the 1988 survey refer to all training programs dating back to the 1986 interview. Respondents were asked about training annually after 1988.

[2] In 1992, the Youth survey included oversamples of blacks and Hispanics.

[3] The only type of training in which categorization is somewhat ambiguous is apprenticeships. Apprenticeships often involve both on-the-job training along with course work which may take place off-site. In this analysis, apprenticeships are included in the "on-site" category, although the results for the most part are unaffected if apprenticeships are considered "off-site" (95 sample members participated in apprenticeships).

[4] Another reason that the components of the "other paid" category are grouped together is because cell sizes within each of these components are relatively small, particularly when subdivided into previous and current training. The primary component of "other paid" training is self or family (63.2 percent), followed by government (14.7 percent).

[5] 1,217 individuals were dropped due to eliminating those with six or more years of tenure. Mean tenure among sample members is 118.44 weeks.

[6] Since individuals can participate in more than one form of training, the overall percentages for the location or payer categories are slightly less than the sum of the percentages in the table. For instance, 27.3 percent received "on-site" training, while 33.2 experienced "company paid" training.

[7] In creating the sample, observations that are clearly outliers were omitted (about 2 percent of the reported durations).

[8] Respondents can report earnings over any time frame (hour, day, month, etc.). For those who do not report an hourly wage, one is constructed using usual hours worked

over the time frame. The CPI-U-X1 is used to convert all wages to 1992 dollars. The average starting wage is $9.17.

[9] The AFQT was administered to all respondents in 1980. Since individuals were of different ages when they took the test, the score used in the regressions is divided by the mean score for the respondent's age.

[10] The institutional information was merged by matching the first three digits of zip codes of the occupational schools with that of NLSY respondents. The Institutional Characteristics Survey was sent to all postsecondary institutions in the United States and outlying areas. Of the 10,760 institutions which were identified, 9,981 responded to the survey.

[11] While no single instrumental variable is used to identify the job mobility selection term, identification is achieved through the different nature of the specifications. The job mobility probit is estimated using 1992 characteristics as independent variables, while in the fixed-effects wage regressions, the independent variables are in change form.

[12] Since the duration of training variables can equal zero, the training variables used in the regressions were generated by taking the natural log of one plus the training duration.

[13] 3.2 percent of the sample were in training at the 1992 interview date. When the "currently in training" variable is divided into location and payer categories, the estimated coefficients on these variables are all insignificant.

[14] Estimates from the training receipt probit as well as from the job mobility probit are provided in the Appendix.

[15] The use of a single selection term implicitly assumes that the same unmeasured characteristics affect participation in the different forms of training. Specifications which include separate selection terms for "company paid" and "other paid," as well as specifications which include selection terms for "on-site" and "off-site" yield qualitatively similar to those reported here, and the selection terms are insignificant.

[16] In the first-differenced equations, results from parsimonious specifications which include change in experience as the only control variable are reported. The estimates on the reported coefficients are virtually unchanged when other variables, such as the change in the local unemployment rate or change in marital status are also included.

[17] Estimates from specifications which include job mobility selection terms for males and females are similar to the reported results and the selection terms are insignificant for both men and women.

[18] Similar to the change in starting wage regressions, a limited set of controls (change in experience and change in tenure) are included in the first-differenced wage growth equations. Estimates from specifications which include additional controls are similar to those reported.

[19] The NLSY does provide information as to whether an employer makes available certain fringe benefits to workers. Yet there is no information as to whether workers actually receive any of the benefits or the value of the benefits.

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Table 1. The Incidence and Duration of Training from 1986 to 1992.

Type of training		Duration in hours among recipients		
	Percent Who Received Training	Mean	Standard Deviation	Median
On-site, company paid (ON-CP)	25.41	162.46	347.29	50.00
On-site, other paid (ON-OP)	3.41	151.95	347.46	32.00
Off-site, company paid (OFF-CP)	14.60	130.39	396.79	40.00
Off-site, other paid (OFF-OP)	16.20	450.73	682.95	160.00

Note: The number of observations is 4309.

Table 2. Log Starting Wage Regressions.

Variable	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	All	All	All	Males	Females
Previous:						
ON-CP	.009 (1.55)	.009 (1.47)	.014** (2.00)	.006 (.39)	.012 (1.60)	.003 (.40)
ON-OP	.005 (.38)	.005 (.39)	.014 (.85)	-.026 (.79)	.021 (1.17)	-.017 (.99)
OFF-CP	.023** (2.44)	.023** (2.91)	.043** (4.40)	-.019 (1.00)	.016 (1.57)	.035** (3.10)
OFF-OP	-.013** (3.02)	-.012** (2.44)	-.021** (2.84)	-.025** (3.10)	-.016** (2.48)	-.013** (2.35)
Current:						
ON-CP	.012** (2.42)	.013** (2.18)	.017** (2.63)	.001 (.05)	.020** (2.71)	.003 (.48)
ON-OP	.020 (1.19)	.020 (1.20)	.020 (.99)	.092* (1.68)	.001 (.05)	.054** (1.96)
OFF-CP	.015** (2.14)	.016** (2.07)	.028** (3.22)	-.005 (.30)	.013 (1.39)	.015 (1.37)
OFF-OP	.001 (.06)	.001 (.15)	.008 (.65)	-.004 (.28)	-.004 (.38)	.002 (.18)
Currently in training	-.020 (.48)	-.019 (.44)	-.019 (.46)	-.008 (.19)	-.060 (.99)	.030 (.62)
Previous experience	.074** (6.87)	.074** (6.91)	.073** (6.79)	.076** (7.05)	.087** (4.59)	.057** (4.32)
Education	.464** (9.01)	.464** (9.06)	.455** (8.84)	.473** (9.16)	.371** (4.87)	.567** (8.11)
AFQT	.117** (4.59)	.117** (4.55)	.114** (4.49)	.130** (5.10)	.119** (3.37)	.127** (3.40)
λ (training probit)		-.002 (.14)				
Constant	.174 (.34)	.050 (.32)	.163 (.32)	.173 (.34)	.469 (.83)	.044 (.19)

Table 2 (Cont.)

	(1)	(2)	(3)	(4)	(5)	(6)
	All	All	All	All	Males	Females
$\bar{R}^2$	.31	.31	.31	.30	.26	.33
Number of observations	4309	4309	4309	4309	2221	2088

Notes: Numbers in parentheses are t-statistics. Additional covariates include sex, race/ethnicity, union, SMSA, firm size (3 variables), married, healthy and industry and occupation dummies (see Appendix for means). All continuous variables are in logarithmic form. In specifications (1), (2), (5), and (6), the training variables refer to log hours. In specification (3), the training variables refer to log training intensity (cumulative hours per week). In specification (4), the training variables to log weeks only for those durations of four weeks or more.

* Statistically significant at the 10-percent level.
** Statistically significant at the 5-percent level.

Table 3. Fixed-Effect Change in Log Starting Wage Regressions.

Variable	Specification (1)	(2)	(3)	(4)
	All	All	Males	Females
Δ Previous:				
ON-CP	.011 (1.46)	.010 (1.22)	.015 (1.45)	.006 (.52)
ON-OP	-.040** (2.14)	-.039** (2.13)	-.044* (1.76)	-.032 (1.11)
OFF-CP	.025* (1.91)	.025** (1.98)	.032* (1.86)	.017 (.87)
OFF-OP	-.016 (1.21)	-.017 (1.31)	-.022 (1.27)	-.010 (.52)
Δ Current:				
ON-CP	.023** (3.32)	.022** (3.04)	.030** (3.20)	.015 (1.45)
ON-OP	.003 (.11)	.002 (.06)	-.005 (.17)	.016 (.42)
OFF-CP	.009 (.86)	.008 (.77)	.011 (.77)	.007 (.42)
OFF-OP	.011 (1.01)	.011 (.95)	.014 (.88)	.009 (.58)
Currently in training	.045 (.69)	.039 (.60)	.056 (.71)	.031 (.27)
Δ Experience	.0002 (.82)	.0002 (1.24)	-.0001 (.40)	.0005* (1.68)
λ (mobility probit)		.231** (2.76)		
Constant	.079** (3.68)	-.101 (1.47)	.092** (3.12)	.063** (2.02)
$\bar{R}^2$	.01	.01	.01	.01
Number of observations	2237	2237	1206	1031

Note: Absolute value of t-statistics are in parentheses. All variables except currently in training and the selectivity term are in logarithmic form.

*Statistically significant at the 10-percent level.
**Statistically significant at the 5-percent level.

Table 4. Wage Growth Regressions.

Variable	Specification			
	(1)	(2)	(3)	(4)
	All	All	Males	Females
Previous:				
ON-CP	-.005	-.005	-.010**	.002
	(1.34)	(1.28)	(1.99)	(.32)
ON-OP	-.002	-.002	.001	-.006
	(.27)	(.29)	(.07)	(.51)
OFF-CP	-.001	-.001	-.002	-.001
	(.11)	(.15)	(.37)	(.09)
OFF-OP	.001	.001	-.002	.004
	(.38)	(.24)	(.49)	(.93)
Current:				
ON-CP	.009**	.008**	.005	.012**
	(2.49)	(2.10)	(1.02)	(2.32)
ON-OP	.008	.008	.017	-.009
	(.70)	(.69)	(1.23)	(.45)
OFF-CP	.017**	.016**	.015**	.019**
	(3.50)	(3.26)	(2.47)	(2.47)
OFF-OP	-.002	-.003	.003	-.004
	(.43)	(.54)	(.47)	(.62)
Currently in training	.007	.006	.022	-.009
	(.25)	(.22)	(.57)	(.22)
Tenure	.030**	.030**	.032**	.027**
	(6.76)	(6.79)	(5.31)	(4.10)
Previous experience	-.007	-.007	.003	-.014
	(.92)	(.92)	(.24)	(1.44)
Education	.031	.030	.061	.010
	(.90)	(.89)	(1.27)	(.20)
AFQT	.014	.015	.010	.026
	(.82)	(.86)	(.43)	(.98)
λ (training probit)		.011		
		(1.10)		
Constant	-.413	.129	-.565	.002
	(1.23)	(1.24)	(1.58)	(.01)

Table 4 (Cont.)

	(1)	(2)	(3)	(4)
	All	All	Males	Females
$\bar{R}^2$	.04	.04	.04	.05
Number of observations	4309	4309	2221	2088

Note: Absolute value of t-statistics are in parentheses. Additional covariates are the same as in Table 2. All variables except currently in training and the selectivity term are in logarithmic form.

*Statistically significant at the 10-percent level.
**Statistically significant at the 5-percent level.

Table 5. Fixed-Effect Wage Growth Regressions.

Variable	Specification (1)	(2)	(3)	(4)
	All	All	Males	Females
Δ Previous:				
ON-CP	-.009 (1.28)	-.009 (1.31)	.001 (.04)	-.021* (1.70)
ON-OP	.019 (1.14)	.019 (1.15)	-.007 (.36)	.047 (1.59)
OFF-CP	.018 (1.50)	.018 (1.52)	.015 (1.11)	.020 (.98)
OFF-OP	-.015 (1.24)	-.015 (1.25)	-.016 (1.17)	-.014 (.68)
Δ Current:				
ON-CP	.005 (.80)	.005 (.78)	-.008 (.98)	.019* (1.78)
ON-OP	.013 (.59)	.013 (.59)	.156 (.61)	.020 (.53)
OFF-CP	.034** (3.35)	.034** (3.35)	.028** (2.47)	.042** (2.34)
OFF-OP	-.017* (1.68)	-.017* (1.68)	-.019 (1.55)	-.017 (1.02)
Currently in Training	-.017 (.29)	-.018 (.30)	.001 (.01)	.060 (.50)
Δ Tenure	.023** (3.22)	.022** (3.08)	.031** (3.79)	.013 (1.05)
Δ Experience	-.0003 (1.60)	-.0003 (1.58)	-.0001 (.51)	-.0005 (1.57)
λ (mobility probit)		.033 (.44)		
Constant	.082** (3.89)	.057 (.93)	.065** (2.57)	.097** (2.78)
$\bar{R}^2$	.02	.02	.02	.02
Number of observations	2237	2237	1206	1031

Note: Absolute value of t-statistics are in parentheses. All variables except currently in training and the selectivity term are in logarithmic form.

*Statistically significant at the 10-percent level.
**Statistically significant at the 5-percent level.

Appendix

Variable	Mean	Training Receipt Probit	Job Mobility Probit
Previous experience (in weeks)	391.03	.0001 (.08)	.001** (8.41)
Education	13.00	.024** (2.00)	.030** (2.61)
Score on Armed Forces Qualifying Test (AFQT)	64.83	.687** (7.89)	-.114 (1.35)
Establishment size	477.95	.0001 (.90)	-.0001 (1.21)
Multiple site firm	.61	.145** (2.83)	.117** (2.33)
Over 1000 employees at other location	.34	.034 (.65)	-.075 (1.45)
Local unemployment rate	7.90	-.001 (.06)	-.004 (.51)
Male	.52	.008 (.17)	.068 (1.50)
Black	.29	.167** (2.97)	.073 (1.35)
Hispanic	.19	.031 (.52)	.003 (.06)
Union member	.15	.059 (1.00)	-.117** (2.05)
Reside in SMSA	.77	.047 (.86)	-.128 (.26)
Married	.53	.096** (2.31)	-.175** (4.37)
Healthy	.94	-.124 (1.49)	-.098 (1.22)
Professional and Technical	.17	.306** (2.86)	-.034 (.34)
Managers	.10	.511** (4.68)	-.118 (1.13)

Appendix (Cont.)

Variable	Mean	Training Receipt Probit	Job Change Probit
Sales	.05	.501**	-.114
		(3.83)	(.91)
Clerical	.18	.239**	.049
		(2.34)	(.51)
Operative	.14	.108	.042
		(1.09)	(.45)
Crafts Workers	.11	.331**	-.065
		(3.27)	(.69)
Service and Private Household	.17	.356**	.077
		(3.49)	(.80)
Agriculture and Mining	.03	-.239*	-.191
		(1.82)	(1.58)
Construction	.07	-.416**	.113
		(4.16)	(1.21)
Transportation	.06	.209**	.017
		(2.28)	(.20)
Wholesale and Retail Trade	.18	-.212**	-.007
		(2.93)	(.10)
Finance	.06	.317**	-.043
		(3.07)	(.44)
Business	.08	.107	-.058
		(1.23)	(.68)
Personal Services and Entertainment	.06	- 189*	-.137
		(1.85)	(1.38)
Professional Services	.22	.012.	-.089
		(.16)	(1.23)
Public Administration	.06	.437**	-.086
		(4.21)	(.86)
Number of occupational schools in locality	20.22	-.005	
		(.50)	
Enrollment of largest occupational school in locality	9299.50	.0001**	
		(2.26)	

Appendix (Cont.)

Variable	Mean	Training Receipt Probit	Job Mobility Probit
Constant		-1.52**	-.423**
		(7.51)	(2.20)
Log-likelihood		-2727.0	-2983.6
Number of observations		4309	4309

Notes: Absolute value of t-statistics are in parentheses. The omitted occupational category is laborers and farmers and the omitted industrial category is manufacturing.

*Statistically significant at the 10-percent level.
**Statistically significant at the 5-percent level.

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